

## FISH OTOLITHS FROM THE PLIOCENE OF SOUTH AUSTRALIA

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## SUMMARY

Otoliths of a new fossil species *Sillago pliocenica* are described from Pliocene sands underlying the Adelaide Plains. The otoliths suggest that the fish is more closely related to an Indo-Pacific species than to the species living in South Australian waters today.

## INTRODUCTION

In a study of Tertiary fish faunas considerable difficulty is encountered when systematic classification of the Teleostomi is attempted owing to the almost complete absence of skeletons. One is usually confronted with odd vertebrae, fin-spines, teeth, etc., which might be assigned to widely separated genera.

This difficulty may be largely overcome by a study of the fish otoliths which are usually found associated with the other isolated fragments. These objects show distinct determinative features which enable exact generic identification to be made by comparison of the fossil with analogous living forms. Although all teleosteans are provided with three pairs of distinct otoliths known respectively as the sagitta, lapillus, and asteriscus, the sagitta is usually the only one of use in diagnosis. Apart from lapilli of the Ariidae, it is the only type of otolith so far known in the fossil form. It may be mentioned that in the Ostariophysi and Cyprinodontes the asteriscus is the predominant otolith, while the lapillus is the principal otolith in the Siluridae.

The morphology of the inner face of a sagitta otolith is shown in fig. 1, which will elucidate its characteristic features.

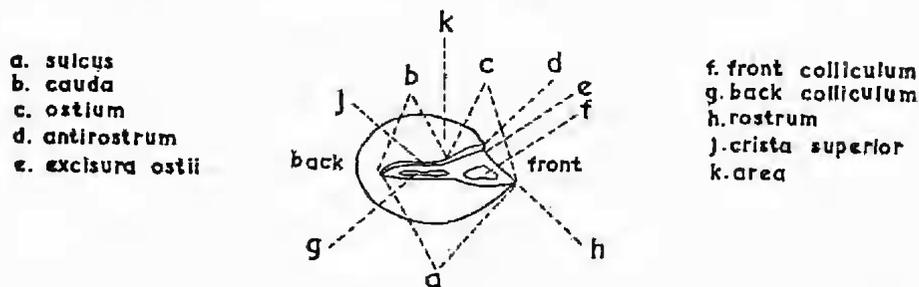
The otoliths described in this paper were obtained from borings into the Dry Creek Sands underlying the Adelaide Plains. They were submitted to the writer by Dr. N. H. Ludbrook, who has drawn the figures and revised the paper for publication.

## SYSTEMATIC DESCRIPTION

Phylum **CHORDATA**Section **CRANIATA**Subphylum **PISCES**Class **ACTINOPTERI (TELEOSTOMI)**Order **PERCOMPRPHI**Suborder **PERCOIDEA**Division **PERCIFORMES**Family **SILLAGINIDAE**Genus **SILLAGO** Cuvier, 1817**SILLAGO** Cuvier, 1817, Regne Animal, 2, 258Type species **SILLAGO ACUTA** Cuvier**Sillago pliocenica** sp. nov.

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*Description of Holotype*—Adult right sagitta otolith. Shape ovate, slightly produced posteriorly; inner face convex, outer face concave. Dorsal rim rounded and somewhat depressed; posterior and anterior rims nearly vertical; ventral rim rounded; all rims smooth. Inner face smooth with a horizontal sulcus running parallel with and close to the dorsal rim. The sulcus is completely enclosed, just touching the anterior rim but not opening on it. It is divided into an ostium and a cauda by a lower angle and a slight notch on the crista superior, the ostium being approximately one-third of the length of the sulcus. The cauda is narrower than the ostium and is somewhat bulbous at its extremity. The sulcus is nearly



a. sulcus  
b. cauda  
c. ostium  
d. antirostrum  
e. excisura ostii

f. front colliculum  
g. back colliculum  
h. rostrum  
j. crista superior  
k. area

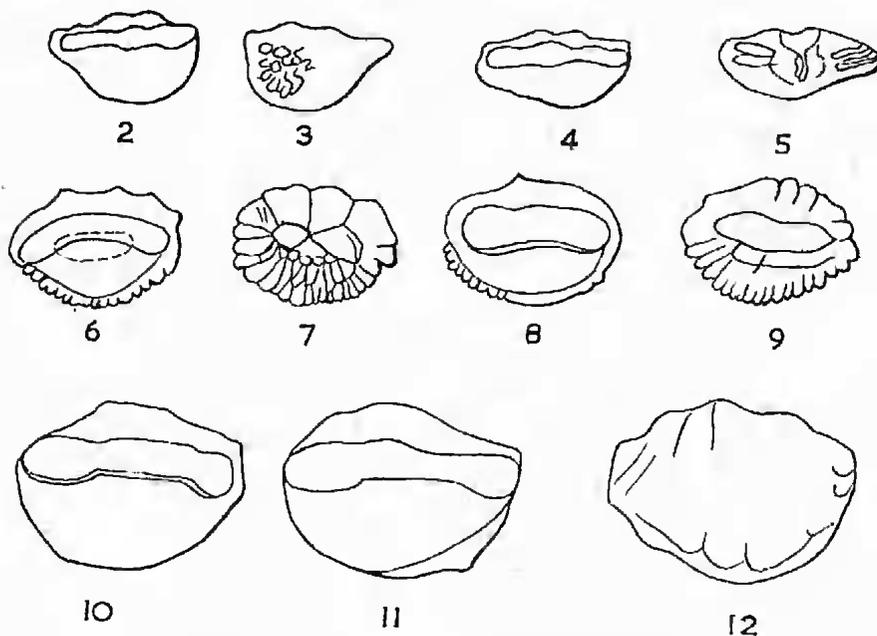


Fig. 1-12

Fig. 1, inner face of sagitta otolith, showing morphological features; fig. 2, *Sillago sihama* Førskal, inner face, X 5; fig. 3, *Sillago sihama* Førskal, otolith, outer face, X 5; fig. 4, *Sillago bassensis* Cuvier and Valenciennes, otolith, inner face, X 2; fig. 5, *Sillago bassensis* Cuvier and Valenciennes, otolith, outer face, X 2; fig. 6, *Sillago pliocenica* sp. nov., otolith, paratype 1, inner face, X 10; fig. 7, *Sillago pliocenica* sp. nov., otolith, paratype 2, outer face, X 10; fig. 8, *Sillago pliocenica* sp. nov., otolith, paratype 2, inner face, X 10; fig. 9, *Sillago pliocenica* sp. nov., otolith, paratype 2, outer face, X 10; fig. 10, *Sillago pliocenica* sp. nov., otolith, paratype 3, inner face, X 7; fig. 11, *Sillago pliocenica* sp. nov., otolith, holotype, inner face, X 7; fig. 12, *Sillago pliocenica* sp. nov., otolith, holotype, outer face, X 7.

filled with colliculi, so that it is almost flush with the surrounding area of the otolith. No rostrum or antirostrum is present.

The character of the outer face changes as the otolith reaches a mature state, and the radial ridges and central tuberosities of the juvenile are obscured by deposition of calcium carbonate, producing an almost smooth surface marked merely by a few indistinct vertical ridges.

*Dimensions*—Length 5.41 mm., width 4.03 mm.

*Paratypes*—Juvenile right and left sagitta otoliths. In the juveniles the rims are denticulated, not smooth as in the adult. Outer face with well-marked radial ridges and central tuberosities.

*Dimensions*—Paratype 1 (fig. 6, 7), length 2.67 mm., width 1.9 mm. Paratype 2, length 2.88 mm., width 2.11 mm.

*Material*—The holotype (fig. 11, 12), Abattoirs Bore; paratypes 1 (fig. 6, 7), 2 (fig. 8, 9), Tennant's Bore, Salisbury; 3 (fig. 10), Abattoirs Bore; eight paratypes Hindmarsh Bore 450 ft.-487 ft.; four paratypes Abattoirs Bore; four paratypes Weymouth's Bore 310 ft.-330 ft.; six paratypes Tennant's Bore; all Dry Creek Sands, Pliocene.

*Location of Types*—Tate Museum Collection, University of Adelaide, with the exception of Hindmarsh and Weymouth's Bore paratypes, which are in the collection of the South Australian Department of Mines.

*Observations*—Comparison of these otoliths with examples from living specimens shows conclusively that they belong to a species of *Sillago*. They are closely allied to the East Indian *Sillago sihama* Førskal, and are less closely allied to the indigenous *S. bassensis* Cuvier and Valenciennes of South Australia, which has relatively longer and narrower otoliths while bearing a superficial resemblance to the fossil forms.

With a view to ascertaining the possible use of otoliths as index fossils the writer has sorted out many thousands of otoliths from most of the British Eocene and Oligocene beds, but has come to the conclusion that they appear to have too wide a stratigraphical range to serve any useful purpose. Considering the tropical affinities of the Dry Creek Sands fauna, the relationship between the otoliths from this Formation and the Recent Indo-Pacific species is worthy of some comment.

#### ACKNOWLEDGMENT

The writer is indebted to Mr. H. M. Hale, Director, South Australian Museum, for specimens of *Sillago bassensis*, and to Dr. E. Trewavas, Department of Zoology, British Museum (Natural History) for an example of *Sillago sihama*.

#### BIBLIOGRAPHY

- The following list of papers dealing with fish otoliths is appended as additional information; the present paper is based on Frost's work.
- FROST, G. A. 1924 Otoliths of Fishes from the Tertiary Formations of New Zealand. *Trans. N.Z. Inst.*, 55, 605-614
- FROST, G. A. 1925a A comparative study of the otoliths of the Neopterygian Fishes. *Ann. Mag. Nat. Hist. ser. 9*, 15, 152-163
- FROST, G. A. 1925b *Ibid.*, 553-561
- FROST, G. A. 1925c *Id.*, 16, 433-446
- FROST, G. A. 1926a *Id.*, 17, 99-104
- FROST, G. A. 1926b *Id.*, 18, 445-482
- FROST, G. A. 1926c *Ibid.*, 483-490
- FROST, G. A. 1927a *Id.*, 19, 439-445
- FROST, G. A. 1927b *Id.*, 20, 298-305

- FROST, G. A. 1928a *Id.*, ser. 10, 1, 451-456  
FROST, G. A. 1928b *Id.*, 2, 328-331  
FROST, G. A. 1928c Otoliths of Fishes from the Tertiary Formations of New Zealand and from Balcombe Bay, Victoria. *Trans. N.Z. Inst.*, 59, 91-97  
FROST, G. A. 1929a A comparative study of the otoliths of the Neopterygian Fishes. *Ann. Mag. Nat. Hist.*, ser. 10, 4, 120-130  
FROST, G. A. 1929b *Ibid.*, 257-264  
FROST, G. A. 1930a *Id.*, 5, 231-239  
FROST, G. A. 1930b *Ibid.*, 621-627  
SHEPHERD, C. E. 1916 Fossil Otoliths. *Knowledge*, 39, (n.s. 13), 177-184, 203-205